

Advanced Learning Algorithms

by DeepLearning.AI & Stanford University

About this Course

In the second course of the Machine Learning Specialization, you will:

- Build and train a neural network with TensorFlow to perform multi-class classification
- Apply best practices for machine learning development so that your models generalize to data and tasks in the real world
- Build and use decision trees and tree ensemble methods, including random forests and boosted trees

The Machine Learning Specialization is a foundational online program created in collaboration between DeepLearning.AI and Stanford Online. In this beginner-friendly program, you will learn the fundamentals of machine learning and how to use these techniques to build real-world AI applications.

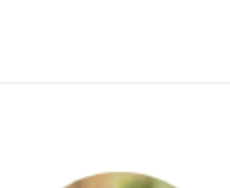
This Specialization is taught by Andrew Ng, an AI visionary who has led critical research at Stanford University and groundbreaking work at Google Brain, Baidu, and Landing.AI to advance the AI field.

This 3-course Specialization is an updated and expanded version of Andrew's pioneering Machine Learning course, rated 4.9 out of 5 and taken by over 4.8 million learners since it launched in 2012.


It provides a broad introduction to modern machine learning, including supervised learning (multiple linear regression, logistic regression, neural networks, and decision trees), unsupervised learning (clustering, dimensionality reduction, recommender systems), and some of the best practices used in Silicon Valley for artificial intelligence and machine learning innovation (evaluating and tuning models, taking a data-centric approach to improving performance, and more.)

By the end of this Specialization, you will have mastered key theoretical concepts and gained the practical know-how to quickly and powerfully apply machine learning to challenging real-world problems. If you're looking to break into AI or build a career in machine learning, the new Machine Learning Specialization is the best place to start.

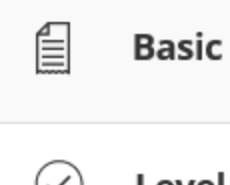
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Taught by: [Andrew Ng](#), Instructor
Founder, DeepLearning.AI & Co-founder, Coursera



Taught by: [Aarti Bagul](#), Curriculum Engineer



Taught by: [Geoff Ladwig](#), Curriculum Engineer
DeepLearning.AI

 Basic Info	Course 2 of 3 in the Machine Learning Specialization
 Level	Beginner
 Commitment	At the rate of 5 hours a week, it typically takes 4 weeks to complete this course.
 Language	English, Subtitles: Arabic, French, Bengali, Ukrainian, Chinese (Simplified), Greek, Italian, Portuguese (Brazil), Dutch, Korean, German, Pashto, Urdu, Russian, Thai, Indonesian, Swedish, Turkish, Azerbaijani, Spanish, Dari, Hindi, Japanese, Kazakh, Hungarian, Polish
 How To Pass	Pass all graded assignments to complete the course.
 User Ratings	 Average User Rating 4.9

Syllabus

Week 1






Neural Networks

This week, you'll learn about neural networks and how to use them for classification tasks. You'll use the TensorFlow framework to build a neural network with just a few lines of code. Then, dive deeper by learning how to code up your own neural network in Python, "from scratch". Optionally, you can learn more about how neural network computations are implemented efficiently using parallel processing (vectorization).

 17 videos, 1 reading

1. **Video:** [Welcome!](#)
2. **Video:** Neurons and the brain
3. **Video:** Demand Prediction
4. **Video:** Example: Recognizing Images
5. **Reading:** [IMPORTANT] Have questions, issues or ideas? Join our Forum!
6. **Video:** Neural network layer
7. **Video:** More complex neural networks
8. **Video:** Inference: making predictions (forward propagation)
9. **Ungraded Lab:** Neurons and Layers
10. **Video:** Inference in Code
11. **Video:** Data in TensorFlow
12. **Video:** Building a neural network
13. **Ungraded Lab:** Coffee Roasting in Tensorflow
14. **Video:** Forward prop in a single layer
15. **Video:** General implementation of forward propagation
16. **Ungraded Lab:** CoffeeRoastingNumPy
17. **Video:** Is there a path to AGI?
18. **Video:** How neural networks are implemented efficiently
19. **Video:** Matrix multiplication
20. **Video:** Matrix multiplication rules
21. **Video:** Matrix multiplication code

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-  **Graded:** Practice quiz: Neural networks intuition
-  **Graded:** Practice quiz: Neural network model
-  **Graded:** Practice quiz: TensorFlow implementation
-  **Graded:** Practice quiz: Neural network implementation in Python
-  **Graded:** Practice Lab: Neural Networks for Binary Classification

Week 2

Neural network training






This week, you'll learn how to train your model in TensorFlow, and also learn about other important activation functions (besides the sigmoid function), and where to use each type in a neural network. You'll also learn how to go beyond binary classification to multiclass classification (3 or more categories). Multiclass classification will introduce you to a new activation function and a new loss function. Optionally, you can also learn about the difference between multiclass classification and multi-

[^ More](#)

 15 videos

1. **Video:** [TensorFlow implementation](#)
2. **Video:** Training Details
3. **Video:** Alternatives to the sigmoid activation
4. **Video:** Choosing activation functions
5. **Video:** Why do we need activation functions?
6. **Ungraded Lab:** ReLU activation
7. **Video:** Multiclass
8. **Video:** Softmax
9. **Video:** Neural Network with Softmax output
10. **Video:** Improved implementation of softmax
11. **Video:** Classification with multiple outputs (Optional)
12. **Ungraded Lab:** Softmax
13. **Ungraded Lab:** Multiclass
14. **Video:** Advanced Optimization
15. **Video:** Additional Layer Types
16. **Video:** What is a derivative? (Optional)
17. **Video:** Computation graph (Optional)
18. **Video:** Larger neural network example (Optional)
19. **Ungraded Lab:** Optional Lab: Derivatives
20. **Ungraded Lab:** Optional Lab: Back propagation

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-  **Graded:** Practice quiz: Neural Network Training
-  **Graded:** Practice quiz: Activation Functions
-  **Graded:** Practice quiz: Multiclass Classification
-  **Graded:** Practice quiz: Additional Neural Network Concepts
-  **Graded:** Practice Lab: Neural Networks for Multiclass classification

Week 3





Advice for applying machine learning

This week you'll learn best practices for training and evaluating your learning algorithms to improve performance. This will cover a wide range of useful advice about the machine learning lifecycle, tuning your model, and also improving your training data.

 17 videos

1. **Video:** [Deciding what to try next](#)
2. **Video:** Evaluating a model
3. **Video:** Model selection and training/cross validation/test sets
4. **Ungraded Lab:** Optional Lab: Model Evaluation and Selection
5. **Video:** Diagnosing bias and variance
6. **Video:** Regularization and bias/variance
7. **Video:** Establishing a baseline level of performance
8. **Video:** Learning curves
9. **Video:** Deciding what to try next revisited
10. **Video:** Bias/variance and neural networks
11. **Ungraded Lab:** Optional Lab: Diagnosing Bias and Variance
12. **Video:** Iterative loop of ML development
13. **Video:** Error analysis
14. **Video:** Adding data
15. **Video:** Transfer learning: using data from a different task
16. **Video:** Full cycle of a machine learning project
17. **Video:** Fairness, bias, and ethics
18. **Video:** Error metrics for skewed datasets
19. **Video:** Trading off precision and recall


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-  **Graded:** Practice quiz: Advice for applying machine learning
-  **Graded:** Practice quiz: Bias and variance
-  **Graded:** Practice quiz: Machine learning development process
-  **Graded:** Practice Lab: Advice for Applying Machine Learning

Week 4





Decision trees

This week, you'll learn about a practical and very commonly used learning algorithm the decision tree. You'll also learn about variations of the decision tree, including random forests and boosted trees (XGBoost).

 14 videos, 2 readings

1. **Video:** [Decision tree model](#)
2. **Video:** Learning Process
3. **Video:** Measuring purity
4. **Video:** Choosing a split: Information Gain
5. **Video:** Putting it together
6. **Video:** Using one-hot encoding of categorical features
7. **Video:** Continuous valued features
8. **Video:** Regression Trees (optional)
9. **Ungraded Lab:** Optional Lab: Decision Trees
10. **Video:** Using multiple decision trees
11. **Video:** Sampling with replacement
12. **Video:** Random forest algorithm
13. **Video:** XGBoost
14. **Video:** When to use decision trees
15. **Ungraded Lab:** Optional Lab: Tree Ensembles
16. **Reading:** [IMPORTANT] Reminder about end of access to Lab Notebooks
17. **Video:** Andrew Ng and Chris Manning on Natural Language Processing
18. **Reading:** Acknowledgements

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-  **Graded:** Practice quiz: Decision trees
-  **Graded:** Practice quiz: Decision tree learning
-  **Graded:** Practice quiz: Tree ensembles
-  **Graded:** Practice Lab: Decision Trees

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How It Works

General

How do I pass?

To earn your Certificate, you'll need to earn a passing

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Programming assignments


Programming assignments require you to write and run a computer program to solve a problem.

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Course 2 of Specialization

#BreakIntoAI with Machine Learning Specialization

Master fundamental AI concepts and develop practical machine learning skills in the beginner-friendly, 3-course program by AI visionary Andrew Ng



Machine Learning
DeepLearning.AI, Stanford University

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